SARRACENIA ROSEA (SARRACENIACEAE), A NEW SPECIES OF PITCHER PLANT FROM THE SOUTHEASTERN UNITED STATES

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ABSTRACT

Sarracenia rosea is described as a new species from the Gulf Coastal Plain of southern Alabama, northwestern Florida, southwestern Georgia, and southeastern Mississippi. Pink petals, large flowers, short scapes, pitchers with thick lips, and lips deeply concave in dorsiventrally pressed pitchers are among the features that distinguish *S. rosea* from its closest relative, *S. purpurea*. *Sarracenia rosea* most often grows in sunny to lightly shaded, wet, acid sites in pinelands. Its infrequent occurrence within a small geographic range makes its conservation of concern.

RESUMEN

Se describe como nueva *Sarracenia rosea* de la Llanura Costera del Golfo del sur de Alabama, noroeste de Florida, sudoeste de Georgia, y sudeste de Mississippi. Los péralos rosas, flores grandes, escapos cortos, utrículos con labios gruesos, y labios muy cóncavos en los utrículos aplastados dorsiventralmente son las mejores características que distinguen *S. rosea* de su pariente más cercano, *S. purpurea*. *Sarracenia rosea* crece la mayoría de las veces en lugares húmedos ácidos en pinares abiertos, de soleados a ligeramente sombríos. El vivir en un área geográfica pequeña, donde aparece con poca frecuencia hace que su conservación sea de interés.

INTRODUCTION

The Western Hemisphere pitcher plants (Sarraceniaceae) are a small family (15–17 species in 3 genera) of perennial herbs endemic to North America and northern South America. Tubular, pitcher-like leaves ("pitchers") enable these plants to lure, trap, digest, and absorb nutrients from a wide variety

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of prey, usually arthropods. Most of these pitcher plant species inhabit sunny, wet, nutrient-poor sites such as bogs, seepages, and wet savannas. The carnivorous habit, peculiar morphology, and unusual ecology of these plants have attracted much interest from horticulturists, ecologists, and systematists. Despite such attention, the ecology, taxonomy, and phylogeny of the Sarraceniaceae remain poorly understood.

The largest genus in the family is *Sarracenia* (10 or 11 species). The most morphologically divergent member of *Sarracenia* is *S. purpurea* L. It is the only species with erect hoods and, consequently, the only species whose pitchers collect rainwater. Other *Sarracenia* species have hoods that cover the mouths of the pitchers, which are moist inside, but not full of water. *Sarracenia purpurea* is the only species in which the pitcher tube is curved, the widest part of the tube is near the middle, and the style expansion is glandular-puncticulate. Congeners have straight tubes, tubes widest at or near their mouths, and nonglandular style expansions. Only *S. purpurea* and *S. psittacina* possess short, decumbent pitchers with wide wings. Other species of *Sarracenia* have relatively long, erect pitchers with relatively narrow wings.

Sarracenia purpurea is often locally abundant within its vast geographic range, which is the largest in the family. Its reported natural range spans 32 degrees of latitude (30–62° N) and 70 degrees of longitude (53–123° W), from southeastern Louisiana, southern Alabama, and northern Florida north in the southern Appalachian mountains and along the Atlantic Coast to eastern Newfoundland and then west across the northeastern United States of America and much of southern Canada to northeastern British Columbia (Macfarlane 1908; McDaniel 1971; Cody & Talbot 1973; Rouleau & Lamoureux 1992).

Largely because of its distinctive morphology, relative frequency, and wide range, *S. purpurea* has a four-century history of study and is the best known member of its genus (Lloyd 1976). Authors have described several infraspecific taxa of *S. purpurea* (Schnell 1979, 1993; Schnell & Determann 1997; Hanrahan & Miller 1998). In our ongoing field, greenhouse, and herbarium studies of the taxonomy of *S. purpurea*, we have discovered that one of these taxa (*S. purpurea* var. *burkii* D.E. Schnell) is more distinct than previously recognized and deserves recognition as a new species.

MATERIALS AND METHODS

We have investigated the morphology, distribution, and habitats of *S. purpurea* and the new species in the field at as many sites as possible throughout its geographic range. For the new species, we studied it at 26 sites in Alabama, Florida, and Mississippi. We studied *S. purpurea* in 4 Canadian provinces and 12 states of the U.S.A. We also borrowed specimens from or studied

specimens at the following 20 herbaria: AUA, DHL, FLAS, FSU, IBE, KNK, KY, LSU, MICH, MO, NCU, NY, OS, PH, TENN, US, USAM, USCH, VDB, and WKU. Abbreviations of herbaria are those of Holmgren et al. (1990).

Previous authors vary in their terminology for the morphology of *Sarracenia purpurea*. In order to standardize terminology and make our descriptions of characters unambiguous, we picture and use the following terms for portions of the pitchers: hood, mouth, lip, tube, wing, and petiole (Fig. 1A). Terms for the description of reproductive morphology are relatively straightforward, with the exception of style expansion, which we have illustrated in Fig. 1B.

Of the herbarium specimens we examined, including our own collections, we selected a representative subset to measure for statistical analyses. We chose only mature specimens that had grown in sunny or lightly shaded habitats because pitchers etiolate and pitcher plants exhibit reduced growth in heavily shaded habitats. For specimens collected by others, we used habitat information on labels and the presence of reddish venation strongly contrasting with the ground color of pitchers as evidence of growth in high-light environments. We also chose specimens that exhibited the full range of morphologic variation for *S. purpurea* and the new species and that originated from throughout the ranges of the two taxa. The set of specimens we measured includes all of the subspecies and varieties currently recognized in *S. purpurea*. Each measured specimen of the new species is denoted by an asterisk following its herbarium of deposit in the citation of types and of representative specimens. Citations of measured specimens of *S. purpurea* can be found in the Appendix. Specimen citations have been purposely abbreviated because of conservation concerns.

We measured at least 74 specimens for most characters of *S. purpurea* and at least 39 specimens for most characters of the new species. Sample sizes vary for the characters since some collections lacked a particular feature or the manner of specimen preparation made measurement impossible. We measured each character only once per specimen. When measuring a structure that is present more than once on a specimen (e.g. petals), we measured the one with the greatest value for a measurement. When measuring the width or thickness of a structure, we measured it at its widest or thickest point. We measured maximum distance of the lip from the horizontal, lip thickness, and style arm length as in Fig. 2. For style arm length and petal length, we measured only styles and petals that were fully expanded. To assess the degree to which *S. purpurea* and the new species differed from each other for each character, we used the independent-samples *t*-test. Because the variances of several characters are heterogeneous (as determined

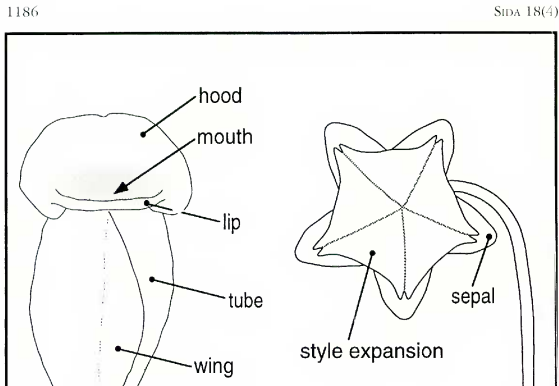

FIG. 1. Morphology of *Sarracenia purpurea* and *S. rosea*. A. Pitcher. B. Flower after shedding of petals. The flower is turned to reveal the style expansion, which faces the ground in these pendent flowers.

by the Bartlett chi-square test for homogeneity of group variances), we transformed the data with the common logarithm before conducting the *t*-tests. All statistical analyses were performed on a Macintosh computer using SYSTAT version 5.1 (Wilkinson 1989). In Table 1, we report sample sizes, summary statistics, and *t*-values for the measurements of the characters we discovered that best distinguish *S. purpurea* and the new species.

To study the lectotype of *S. purpurea* (McDaniel 1971), which is plate 70 of Catesby (1738), we measured the plate directly as if it were a pressed specimen. Direct measurement is justified because Catesby's depictions of *S. purpurea* and a frog on the plate are life-sized. In text accompanying plate 70, Catesby states, "These frogs are of various sizes, tho' commonly about the bigness of the figure. ..." We did not include measurements of the lectotype in the data or analyses presented in Table 1.

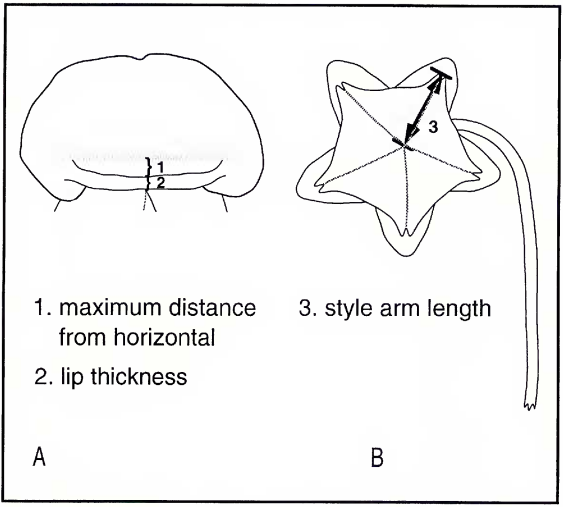

FIG. 2. Methods of measurement of specific diagnostic features of *Sarracenia purpurea* and *S. rosea*. A. Distal portion of pitcher, with diagnostic features of the lip indicated. B. Flower after shedding of petals, with style arm length indicated.

As an additional means of studying the morphology of *S. purpurea* and the new species, we cultivated plants of them under common conditions in the Case greenhouse in Saginaw, Michigan. In the greenhouse, we grew plants from 8 populations of *S. purpurea* (3 from the southern Appalachians, 3 from the Coastal Plain of North and South Carolina, and 2 from Michigan) and 7 populations of the new species (Alabama and Florida). Plants were cultivated for 15–25 years in pots with soil from the same source and watered from a common supply, as described by Case and Case (1976).

For determination of the flowering period of the new species, we considered only specimens bearing at least one fully expanded petal. To determine the geographic range of the new species, we used only herbarium specimens that we examined; each point on the map is based on at least one herbarium specimen.

RESULTS AND DISCUSSION

Sarracenia rosea Naczi, F.W.Case, & R.B.Case, sp. nov. (**Figs. 3, 8**). TYPE: U.S.A. FLORIDA. Liberty Co.: SW of Telogia, Apalachicola National Forest, 17 May 1993, *Naczi 3016* (HOLOTYPE: MICH*; ISOTYPES: NY*, US*).

Sarracenia purpurea ssp. *venosa* (Raf.) Wherry var. *burkii* D.E.Schnell, Rhodora 95:8. 1995. TYPE: U.S.A. ALABAMA. Washington Co.: off U.S. 45 near Deer Park, 4 Apr 1992, *Schnell s.n.* (HOLOTYPE: NCU, n.v.). Schnell's taxonomic concept is clear from his color photograph (Schnell 1995:7).

A *Sarracenia purpurea* petalis roseis, scapis brevioribus (16.3–35.1 cm longis), floribus grandioribus (bracchiis stylorum 2.6–4.1 cm longis), labiis ascidiorum crassioribus (2.6–7.5 mm crassis), labiis ascidiorum profunde curvis bases versus ascidiorum in speciminibus exsiccatis dorsiventraliter complanatis differt.

Perennial herb. **Rhizomes** usually horizontal, occasionally vertical, 1.2–5.8 cm long, 0.8–1.8 cm wide. **Pitchers** decumbent to ascending, in basal rosettes, 4–9 in each rosette, 5.9–28.1 cm long, 2.3–6.8 cm wide at tube, 2.1–5.3 times as long as wide, hooded terminally, lipped at mouth, tube arcuate, winged exteriorly on adaxial surface of tube, petiolate. **Hood** erect, reniform to broadly cordate, apex usually slightly recurved and thus often emarginate in dorsiventrally pressed pitchers, otherwise entire, usually coarsely wavy in abaxial-adaxial plane in life, unconstricted at base and broadly attached to tubular portion of pitcher, 1.8–6.1 cm high, 3.3–13.4 cm wide, 1.5–3.7 times as wide as high, extending laterally from pitcher mouth 0.8–4.2 cm on each side, extending basally from pitcher mouth 0.7–2.8 cm on each side; adaxial surface pubescent with moderately dense, coarse, stiff, decurved hairs 1.0–2.1 mm long, coarsely reticulately veined with veins usually deep red or purple-red and contrasting with background, background pale green or pale green suffused with purple-red; abaxial surface pubescent with moderately dense, fine, soft, appressed hairs 0.3–0.8 mm long, color as on adaxial surface except color of veins usually contrasting less with background color. **Mouth** 1.9–5.3 cm wide; lip 2.6–7.5 mm thick, curved basally in dorsiventrally pressed pitchers, with maximum distance from horizontal at junction of lip and wing, this maximum distance 2.4–9.7 mm. **Tube** obovate in dorsiventrally pressed pitchers, slightly constricted apically to wide mouth, gradually tapered basally to narrow petiole, 3.3–17.0 cm long, 2.3–6.8 cm wide; ventricose in laterally pressed pitchers, strongly outcurved abaxially, plane or slightly incurved adaxially; pubescent with moderately dense, fine, soft, appressed hairs 0.3–0.8 mm long except glabrous or sparsely pubescent on abaxial surface; pale green or pale green suffused with dull purple-red, frequently with longitudinal veins and some cross-veins dull red and contrasting with paler background. **Wing** semi-oblanceolate to semicircular, 3.2–16.6 cm long, 0.6–5.4 cm wide, pubescence and color as on tube. **Petiole** solid, 0.2–6.3 cm long, decurved or straight, glabrous. **Flowers** pendent, borne singly on scapes, bracteate. **Scape** 16.3–35.1 cm high, 1.1–

2.8 times as long as longest pitcher per plant, 2.5–5.4 mm wide at mid-height, distally abruptly decurved to point of attachment with flower. **Bracts** appressed to calyx, 3, broadly ovate, obtuse, entire, 5–8 mm long, 4–7 mm wide, glabrous, persistent through death of scape and shedding of seeds. **Calyx** 5.7–10.6 cm wide in pressed flowers; sepals proximally imbricate, distally non-overlapping, 5, ovate, obtuse, entire, 3.1–4.7 cm long, 1.7–3.8 cm wide, 1.4–2.3 times as long as wide, glabrous; adaxial surface usually very pale green, with deep purple-red margin at anthesis and for a short time afterward, purple-red margin fading to pale green with age; abaxial surface usually deep purple-red to pale purple-red, rarely pale green; persistent as long as scape and pericarp remain green. **Corolla** 8.7–13.2 cm wide in pressed flowers; petals non-overlapping, 5, pandurate, obtuse, entire, 4.5–6.4 cm long, limb 2.9–4.2 cm long and 2.0–3.5 cm wide, base 1.5–2.3 cm long and 1.5–2.2 cm wide, isthmus 1.1–1.8 cm wide, glabrous, very pale to deep pink or very rarely pale yellow in life, rose to lavender or rarely nearly white when recently dried, fading to pale brown or whitish when dry for a longer time, color of adaxial surface same as color of abaxial surface, shed soon after pollen release. **Androecium** of numerous stamens, 2.4–3.1 cm wide in pressed flowers; filaments 6–13 mm long; anthers 2.7–4.0 mm long, 2.0–3.5 mm wide, yellow to red-brown; shed soon after pollen release. **Gynoecium** of 5 connate carpels; ovary globose, 0.9–1.3 cm high, 1.1–1.4 cm wide, very densely verrucose, pale green or whitish; style basally styliform, styliform portion 0.8–1.0 cm long, apically abruptly expanded and umbraculiform, persistent through death of scape and shedding of seeds; stigmas 5. **Style expansion** pentagonal, each angle slightly elongated and forming a short and emarginate lobe, otherwise entire, 4.8–7.4 cm wide, adaxial surface pubescent and glandular-puncticulate, abaxial surface pubescent and glandular-puncticulate, ribbed, membranous during anthesis, thickening soon after anthesis and becoming coriaceous, pale green to nearly white and sometimes lightly suffused with purple-red; lobes 0.4–1.0 cm long, 0.2–0.3 times as long as style arms, notches 2.9–6.2 mm deep; hairs on adaxial surface of style expansion moderately dense, erect, fine, 0.2–0.6 mm long; hairs on abaxial surface of style expansion sparsely to moderately dense, erect, fine, 0.2–0.5 mm long; glands sparsely to moderately dense on adaxial surface of style expansion, moderately dense on abaxial surface of style expansion, slightly raised, depressed-dome-shaped, 0.06–0.13 mm wide, usually pale to deep red-brown, most prominent during anthesis, becoming obscure with thickening of style expansion; ribs 5, each radiating from center of style expansion and terminating in stigma; style arms 2.6–4.1 cm long, 0.078–0.20 as long as scapes. **Stigmas** 0.2–0.6 mm long, 0.4–0.5 mm wide, each restricted to apex of papilla; papillae 5, each in base of notch of style expansion, perpendicular to lobes of style expansion, 0.8–1.6 mm long. **Capsule**

TABLE 1. Morphologic characters that best distinguish *Sarracenia rosea* from *S. purpurea*. Quantitative data are means ± 1 SD and ranges for measurements. *N* = number of specimens measured. The two species differ significantly for all quantitative characters (*t*-test, $P < 0.001$). The quantitative characters are listed in descending order of *t*-value.

Character	*S. rosea*	*S. purpurea*	*t*-value
1. lip thickness (mm)	4.5 ± 1.1 (2.6–7.5) *N* = 48	1.8 ± 0.5 (0.7–3.1) *N* = 85	19
2. scape height/style arm length	8.2 ± 1.8 (4.9–13) *N* = 52	18 ± 4.5 (9.5–33) *N* = 86	18
3. scape height (cm)	25.9 ± 5.03 (16.3–35.1) *N* = 52	44.2 ± 11.3 (22.3–79.1) *N* = 86	13.4
4. style arm length (cm)	3.2 ± 0.34 (2.6–4.1) *N* = 52	2.5 ± 0.44 (1.7–3.8) *N* = 86	9.9
5. lip concavity, maximum distance from horizontal (mm)	5.0 ± 1.7 (2.1–9.7) *N* = 34	0.7 ± 1 (0–5.3) *N* = 65	8.4
6. hairs on adaxial surface of hood, length (mm)	1.5 ± 0.21 (1.0–2.1) *N* = 47	1.2 ± 0.3 (0.6–2.2) *N* = 83	7.5
7. petal length (cm)	5.1 ± 0.48 (4.5–6.4) *N* = 18	4.1 ± 0.45 (3.3–5.3) *N* = 25	7.4
8. scape height/longest pitcher length	2.0 ± 0.47 (1.1–2.8) *N* = 17	3.3 ± 0.74 (1.9–5.2) *N* = 37	7.1
9. sepal length (cm)	3.8 ± 0.41 (3.1–4.7) *N* = 34	3.2 ± 0.42 (2.2–4.2) *N* = 74	6.8
10. mouth width (cm)	3.3 ± 0.72 (1.9–5.3) *N* = 39	2.1 ± 0.44 (1.4–3.6) *N* = 74	6.5
11. petal width (cm)	2.7 ± 0.35 (2.0–3.5) *N* = 18	2.1 ± 0.32 (1.6–2.9) *N* = 25	5.8
12. petal color	usually pink	usually maroon or red	

depressed-globose, 1.1–1.4 cm high, 1.6–2.1 cm wide, densely verrucose, brown, dehiscing basipetally. **Seeds** obovate or oblong in outline, compressed, narrowly ridged along one lateral margin, pyriform in cross-section, 1.8–2.3 mm long, 1.0–1.4 mm wide, brown, verruculose, often slightly glaucous because of a thin coating of wax.

FIG. 3. (Left) *Sarracenia rosea* flowering in the field. Florida, Liberty Co., 15 March 1994, *Naczi 3651*.
FIG. 4. (Right) *Sarracenia purpurea* flowering in the field. Michigan, Chippewa Co., 1995.

Diagnostic Features

Several morphologic features distinguish *S. rosea* from *S. purpurea* (Table 1). The most obvious diagnostic feature is petal color. *Sarracenia rosea* usually has pink petals (Fig. 3), whereas *S. purpurea* has maroon or red petals (Fig 4). Closely correlated with the paler petals of *S. rosea* are paler gynoecia (Schnell 1993), though we have observed *S. purpurea* with pale gynoecia, too. While Schnell (1993) emphasized the pink coloration of the petals in his diagnosis of *S. purpurea* var. *burkii*, previous researchers believed pink petals were the result of a mutation (Wherry 1933) or of a phenotypic response to low light levels (Bell 1949). Through field observations and greenhouse cultivation, we confirm that pink is the predominant color for petals of *S. rosea*. Indeed, among the species (not hybrids) of *Sarracenia*, pink petals are unique to *S. rosea*.

In *S. rosea*, petal color ranges from very pale pink (almost white) to deep pink. Most commonly, the pink is of medium saturation (as in Fig. 3). Bell (1949: 157) mentioned observing *S. rosea* (as *S. purpurea*) near Bay Minette, Alabama that had dark red petals. We agree with Schnell (1993) that such plants are likely introgressants with one of the species that possesses maroon petals, most likely *S. leucophylla* Raf. Putative hybrids of *S. leucophylla* and *S. rosea* (as *S. purpurea*) are reported from several localities, including Bay Minette (Bell 1949, 1952; Bell & Case 1956; McDaniel 1971). Very rarely, plants of both *S. purpurea* and *S. rosea* produce yellow petals, due to failure of anthocyanin production (Sheridan & Mills 1998a, 1998b; Hanrahan & Miller 1998). These yellow-flowered plants also lack reddish coloration

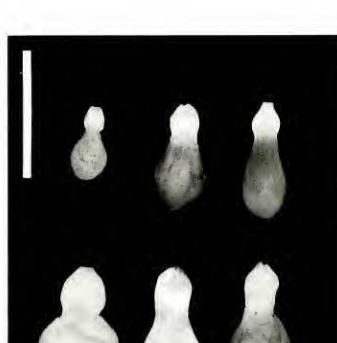

FIG. 5. Petals of *Sarracenia purpurea* (top row) and *S. rosea* (bottom row). Petals pressed and dried from wild, sun-grown plants. Top row (left to right): Pennsylvania, Bradford Co., *Naczi 4322*; Ontario, Thunder Bay Distr., *Garton 18798*; New Jersey, Burlington Co., *Naczi 156A*, 5 Jun 1982. Bottom row (left to right): Florida, Liberty Co., *Kral 63291*; Florida, Liberty Co., *Naczi 3651*; Alabama, Mobile Co., *Kral 16530*. Scale bar = 5cm.

in pitchers and calyces. This variation of *S. purpurea* is *S. purpurea* f. *heterophylla* (Eaton) Fernald. For *S. rosea*, the analogous form has been described by Hanrahan and Miller (1998), but must be transferred from *S. purpurea*, as we do here.

Sarracenia rosea f. **luteola** (Hanrahan & Miller) Naczi, F.W.Case, & R.B.Case, comb. nov. BASIONYM: *Sarracenia purpurea* ssp. *venosa* var. *burkii* f. *luteola* Hanrahan & Miller, Carniv. Pl. Newslett. 27:16. 1998.

In addition to petal color, we found that nearly every feature of the flower is substantially larger in *S. rosea* than in *S. purpurea*. The sepals of *S. rosea* are 3.1–4.7 cm long, whereas those of *S. purpurea* are only 2.2–4.2 cm long. The petals of *S. rosea* are longer and wider than those of *S. purpurea* (Fig. 5): 4.5–6.4 cm long and 2.0–3.5 cm wide for *S. rosea* versus 3.3–5.3 cm long and 1.6–2.9 cm wide for *S. purpurea*. Style size, as measured by style arm length, is greater for *S. rosea* (2.6–4.1 cm) than *S. purpurea* [1.7–2.9(–3.8) cm].

The scapes of *S. rosea* are relatively short, only 16.3–35.1 cm high versus 22.3–79.1 cm high for *S. purpurea*. These short scapes are remarkable in

FIG. 6. Fruiting plant of *Sarracenia purpurea* (left) and of holotype of *S. rosea* (right). Collected from sunny habitats in the wild and pressed and dried. Left: Ontario, Dufferin Co., *Naczi 4514*. Right: Florida, Liberty Co., *Naczi 3016*. Scale bar = 5cm.

light of the comparatively large flowers of *S. rosea*. As a result, the ratio of scape height/style arm length is a particularly strong quantitative character in separating *S. rosea* from *S. purpurea* (Table 1). The values of this ratio are 4.9–13 for *S. rosea* and 9.5–33 for *S. purpurea*. The visual difference between the two species in flower size-scape height proportions is striking (Fig. 6).

Several vegetative characters are also diagnostic. First, the lips of *S. rosea* are thicker than those of *S. purpurea* (Fig. 7): 2.6–7.5 mm thick for *S. rosea* versus 0.7–3.1 mm thick for *S. purpurea*. Second, in dorsiventrally pressed pitchers, the lips of *S. rosea* curve basally, forming a relatively deep concavity. The lips of *S. purpurea* are horizontal or form a shallow concavity. Thus, the maximum distance of the lip from horizontal (the maximum depth of the concavity) is greater in *S. rosea* than *S. purpurea* (Fig. 7): 2.4–9.7 mm for *S. rosea* versus 0–5.3 mm for *S. purpurea*. A third diagnostic feature from the pitchers is the length of the stiff, decurved hairs on the adaxial surface of the hoods. In *S. rosea*, these hairs are (1.0–)1.3–2.1 mm long, whereas they are 0.6–1.6(–2.2) mm long in *S. purpurea*. Fourth, the pitchers of *S. rosea* are relatively thin-walled, while those of *S. purpurea* are thicker. Probably as a result of this difference in thickness, overwintered pitchers of *S. rosea* exhibit slight to extensive winter-kill. Pitchers of *S. purpurea* are evergreen, even on plants in the northern portion of its range.

The pitchers of *S. rosea* tend to be larger than those of *S. purpurea* (Fig. 7).

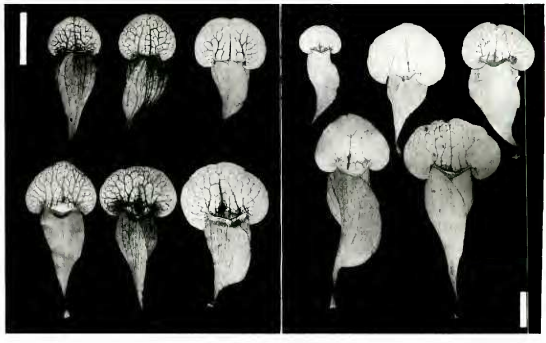

FIG. 7. (Left) Pitchers of *Sarracenia purpurea* (top row) and *S. rosea* (bottom row). Pitchers pressed and dried from wild, mature, and sun-grown plants. Top row (left to right): Ontario, Dufferin Co., *Naczi 4514*; New Jersey, Burlington Co., *Naczi 4433*; North Carolina, Montgomery Co., *Naczi 1975*. Bottom row (left to right): Florida, Liberty Co., *Naczi 3016*; Mississippi, George Co., *Naczi 3057*; Alabama, Mobile Co., *Naczi 3066*. Scale bar = 5cm.

FIG. 8. (Right) Pitchers of *Sarracenia rosea*. Pitchers pressed and dried from wild, mature, and sun-grown plants. Top row (left to right): Alabama, Mobile Co., *Naczi 3053*; Alabama, Mobile Co., *Naczi 2809*; Florida, Escambia Co., *Naczi 3051*. Bottom row (left to right): Alabama, Mobile Co., *Naczi 3066*; Mississippi, George Co., *Naczi 3057*. Scale bar = 5cm.

As a result, the ratio of scape height/longest pitcher length differs for the two species: 1.1–2.8 for *S. rosea* and 1.9–5.2 for *S. purpurea*. Also, pitchers of *S. rosea* have wider mouths (1.9–5.3 cm wide) than those of *S. purpurea* (1.4–3.6 cm wide). However, we find most pitcher dimensions and shapes to be practically useless in unambiguously separating *S. rosea* and *S. purpurea*. Pitchers of both species are quite variable in size and shape (Figs. 7, 8). Measurements of many pitcher characters we studied (pitcher length, pitcher width, hood height, hood width, width of the portion of the hood that extends laterally from the mouth, wing width, pitcher length/pitcher width, hood width/hood height, hood height/pitcher length, hood width/pitcher length, hood height/mouth width, hood width/mouth width, mouth width/pitcher length, mouth width/pitcher width, wing width/pitcher length) overlap extensively for *S. rosea* and *S. purpurea*. The *t*-values for measurements of these characters are all lower than for any of the characters listed in Table 1.

Some of the quantitative characters exhibit clinal variation across the combination of *S. purpurea* and *S. rosea* (Fig. 9A). For example, style arm length is highly correlated with latitude in the combined data set (r =

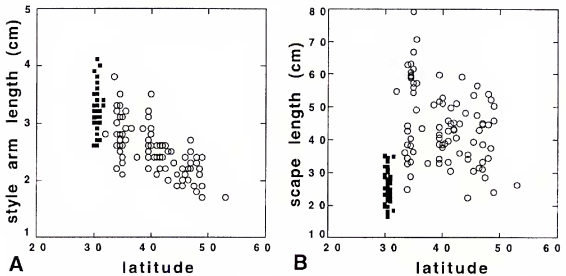

FIG. 9. Scatter plots of some diagnostic features vs. latitude for *Sarracenia purpurea* (open circles) and *S. rosea* (solid squares). A. Cline in style arm length. B. Absence of cline in scape length.

-0.76, $p < 0.001$, $N = 138$), as is length of hairs on the adaxial surface of the hoods ($r = -0.75$, $p < 0.001$, $N = 130$). However, several other characters do not exhibit clinal variation (Fig. 9B). For example, scape length has a very low correlation with latitude ($r = 0.377$, $p < 0.001$, $N = 138$), as does the ratio of scape length/longest pitcher length ($r = 0.34$, $p = 0.012$, $N = 54$). The diagnostic characters that are nonclinal indicate *S. rosea* is not merely the extreme of a cline of *S. purpurea*, but rather a taxon distinct from it.

In summary, several characters can be used to separate *S. rosea* from *S. purpurea* (Table 1). The quantitative features that are the best for distinguishing the species, based on having the highest *t*-values, are both vegetative (lip thickness) and reproductive (scape height/style arm length). Though ranges of measurements for all of the quantitative characters overlap for both species, a scatter plot of scape height/style arm length versus lip thickness separates specimens of *S. rosea* and *S. purpurea* (Fig. 10). This plot and the wealth of other diagnostic features for *S. rosea*, including qualitative characters, clearly indicate *S. rosea* is distinct from *S. purpurea* at the rank of species.

Evidence from additional sources also indicates *S. rosea* deserves recognition as a species. In greenhouse cultivation, the differences between *S. rosea* and *S. purpurea* are maintained. Under common greenhouse conditions for 15 years or more, plants from 7 populations of *S. rosea* continue to possess pink petals, short scapes, thick lips, and deeply concave lips while plants of *S. purpurea* from 8 populations continue to possess maroon petals, tall scapes, thin lips, and horizontal or shallowly concave lips, as examples of some of the differences that are maintained during common cultivation. These re-

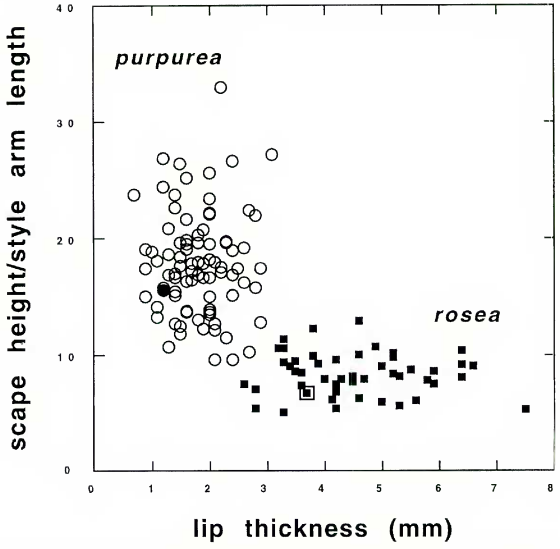

FIG. 10. Scatter plot of scape height/style arm length vs. lip thickness for *Sarracenia purpurea* and *S. rosea*. Open circles represent specimens of *S. purpurea*. The solid circle represents the lectotype of *S. purpurea*, plate 70 of Catesby (1738). Solid squares represent specimens of *S. rosea*, with the boxed square depicting the holotype.

sults suggest the differences we have noted between the species are genetically-based. A second additional source of support for recognizing *S. rosea* comes from allozyme analysis of the *S. purpurea* complex. Godt and Hamrick (1999) discovered that *S. rosea* (as *S. purpurea* var. *burkii*) is the most genetically divergent member of the complex. In addition, the genetic distance between *S. rosea* and *S. purpurea* is relatively large and is similar to that found between many congeneric species (Gottlieb 1977, 1981; Crawford 1983).

Nomenclature

We are unaware of any prior names at the rank of species that apply to *S. rosea*. None of Rafinesque's (1840) names for *Sarracenia* (as "*Sarazina*")

appear to apply to *S. rosea*, though the applications of these names are some what uncertain. Geographically, four of these new names could fit *S. rosea*. Rafinesque stated his *S. venosa*, "...differs from *S. gibbosa* [a northern-ranging new species of his, under which he lists *S. purpurea* as a synonym], by ... flowers smaller—Virg. ad Florida." Clearly, *S. venosa* cannot apply to the large-flowered *S. rosea*. As well, *S. parviflora* Raf. ("... appendice [hood] concavo fornicato ... very distinct sp. of Florida, yet akin to the last [*S. venosa*], leaves 3 to 6 inches long, nervose, flowers very small, purplish.") does not apply to *S. rosea*. Most likely, *S. parviflora* is a synonym of *S. psittacina* Michx. (a quite distinctive species having small flowers and relatively short pitchers with strongly arched and concave hoods), though McDaniel (1971) placed *S. parviflora* in synonymy with *S. purpurea*. Both *S. acuta* Raf. ("fol. tubul. longiss. nervosis ala angustissima ... Alabama ...") and *S. adunca* Raf. ("... fol. tubul. longis ... ala angust. ... Florida ...") do not apply because *S. rosea* has short pitchers with wide wings. Also, *S. adunca* Raf. is preoccupied by *S. adunca* Sm., 1805, a synonym of *S. minor* Walter. Unfortunately, botanists probably will never know the application of Rafinesque's names in *Sarracenia*.Most of Rafinesque's herbarium was discarded soon after his death in 1840 (Stuckey 1971). Previous workers have not located types of Rafinesque's names in *Sarracenia*. Searches by us and herbarium curators for Rafinesque specimens at DWC, G, NY, P, PH, and WIS have been fruitless.

McDaniel (1971) lectotypified *S. purpurea* with plate 70 of *The Natural History of Carolina, Florida and the Bahama Islands* (Catesby 1738). Catesby did not mention the provenance of the illustrated specimen, but most likely it was outside the range of *S. rosea*. His "Map of Carolina, Florida and the Bahama Islands, with the Adjacent Parts" indicates the Florida of his day ranged only as far west as the present-day Aucilla River, east of the range of *S. rosea*. Nevertheless, the possibility that Catesby obtained the plant from further west means the plate must be evaluated before *S. rosea* can be accepted as a correct name. Although the petals are anomalously purplish pink (though described by Catesby as "...of a purple colour..." in text accompanying plate 70), the species illustrated in the plate is otherwise typical *S. purpurea*. Measurements of the plate for nearly every diagnostic character lie within the range for *S. purpurea*, but several are outside the range for *S. rosea*. For example, lip thickness is 1.2 cm, style arm length is 2.1 cm, and the ratio of scape height/style arm length is 16. In addition, the lips appear to be horizontal, not concave, though the partially obscuring hoods make the determination of this condition somewhat uncertain. Measurements of the Catesby plate fall well within the cluster of specimens of *S. purpurea* in the plot of scape height/style arm length versus lip thickness (Fig. 10).

Etymology

We have chosen "rosea," meaning pink, as the epithet for this new species because of its distinctively colored petals. This epithet is descriptive, easily comprehended, and is in the tradition of several other specific epithets in the genus by applying to flower color (e.g. *S. flava* L., *S. rubra* Walter, and *S. purpurea*). We use a new epithet for this species, rather than transfer the epithet used when this taxon was treated as a variety (Schnell 1993), as permitted by article 11.2 of the *International Code of Botanical Nomenclature* (Greuter et al. 1994). Our choice is intended to avoid confusion of ranks that may ensue from using the same epithet for both variety and species. Furthermore, by using a new epithet, we underscore the recognition of *S. rosea* as a species with a suite of features that differentiate it from *S. purpurea*.

Phenology

The flowering period of *S. rosea* extends from mid-March to mid-April, with the peak in the last 10 days of March. The earliest flowering date of herbarium specimens is 14 March and the latest is 20 April. At the time of flowering, pitchers of the current season are usually undeveloped or incompletely developed. Overwintered pitchers are present at the time of flowering, but these are often slightly to nearly completely brown and withered due to winter-kill (Fig. 3).

Typification

For the holotype of *S. rosea* (Fig. 6), we have selected a post-anthesis specimen because it has fully developed pitchers of the current season. In addition, the holotype has the thickened style expansion typical of post-flowering plants. Such a style expansion is less prone to damage than the fragile ones of plants during anthesis. The holotype is quite representative of *S. rosea* for key quantitative features (Fig. 10). Plants observed from the same population as the holotype in the following year uniformly bore flowers with pink petals (*Naczi* 3639).

Distribution

Sarracenia rosea ranges from southwestern Georgia (Tift County) and northwestern Florida (Gadsden County) west to George and Jackson counties, southeasternmost Mississippi (Fig. 11). It occurs solely on the Coastal Plain in the drainage of the Gulf of Mexico. Most populations are within 120 km (75 mi) of the coastline. McDaniel (1966) cites a specimen of *S. purpurea* from Taylor County, Georgia, which we have not seen, that is probably *S. rosea*. The collection locality lies within the Gulf of Mexico drainage, but it is farther north than any other population known and about 300 km (185 mi) from the coast. The range of *S. rosea* is almost identical to that of *S. leucophylla* (McDaniel 1971), with which it often grows.

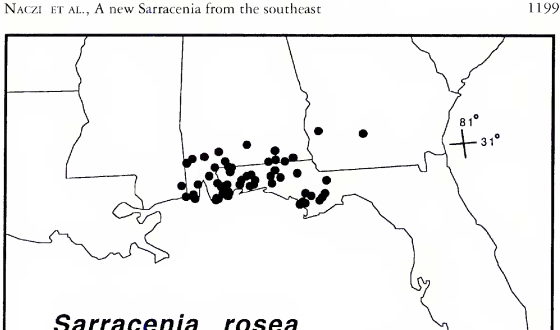

FIG. 11. Distribution of *Sarracenia rosea*, based on voucher specimens we examined.

Sarracenia rosea and *S. purpurea* are allopatric. *Sarracenia purpurea* ranges further north and east of *S. rosea*. The collection of *S. purpurea* that is closest to the range of *S. rosea* is from Tattnall County, Georgia (*Harper 2151*). Thus, a minor disjunction of about 135 km (85 mi) separates the ranges of *S. rosea* and *S. purpurea*. More significantly, *S. purpurea* is apparently absent from the Gulf of Mexico drainage, the Tattnall County site and all other localities in the southeastern U.S.A. being in the Atlantic drainage.

Based on two specimens, *S. purpurea* is reported from Louisiana (MacRoberts & MacRoberts 1988). One would expect these collections to be *S. rosea*, since Louisiana is in the Gulf of Mexico drainage and far from the range of *S. purpurea*. The attribution of *S. rosea* to Louisiana based on these collections is problematic, though. The original label of one of these collections (US 782242) reads, "Sarracenia purpurea/wet pine woods/St. Helena, La." With its lip 1.4 mm thick, lip's maximum distance from horizontal of 1.6 mm, scape height of 42.4 cm, and style arm length of 2.4 cm, this collection is clearly *S. purpurea*, not *S. rosea*. The second collection reputed to be a voucher from Louisiana (LSU 006607) has "Saraceniaceae [sic]/Sarracenia rubra Walt./ Red flowered Trumpetleaf/Covington/AF. ["AL."?]" handwritten on the original label. The specimen is quite fragmentary; it consists of two isolated, laterally pressed pitchers and a portion of a scape bearing only 2 sepals (3 sepals, corolla, androecium, and gynoecium are all lacking). This specimen is also

S. purpurea, since the lip is only 1.1 mm thick. The scape fragment is 30.1 cm high and the longer sepal is 3.3 cm long, both of which are inconclusive since these measurements fall within the range of overlap between *S. purpurea* and *S. rosea*. The collection locality of this specimen may not be Louisiana. The script leaves determination of the final pair of letters equivocal. Instead of "...Covington/AF. [Americus Featherman, a collector in late 19th-century Louisiana]" (MacRoberts & MacRoberts 1988), the label may actually read "...Covington/AL." Thus, the label may actually indicate Covington County, Alabama. The single period after the final pair of letters (*not* after each letter, as one would expect if the correct reading is "A.F.") supports this interpretation. Further support is the fact that *S. rubra* is unknown from Louisiana (Murry & Urbatsch 1979), but does occur in Covington County, Alabama (e.g., *MacDonald 13556*, IBE). Whatever its origin, the specimen does not appear to belong with its label since it is neither *S. rubra* nor *S. rosea*, which would be expected if the collection came from either Covington, Louisiana or Covington County, Alabama. In light of the evidence, we advise caution when considering the inclusion of *S. purpurea* in the flora of Louisiana. It seems more reasonable to discount the two specimens because of possible labeling errors than to accept the disjunct occurrence of *S. purpurea* in Louisiana, a disjunction of about 800 km (500 mi) southwest from the nearest population in Tattnall County, Georgia.

Habitats

Sarracenia rosea usually grows in sunny to lightly shaded, wet, sandy, acid soil in relatively open sites, often with scattered pines and shrubs. Populations of *S. rosea* also occur in ditches, shrubby thickets, edges of swamps, and the dense shade of swamp interiors. In swamps, population densities and the proportion of flowering or fruiting plants are lower than in sunnier habitats. Using the terminology for pitcher plant habitats of Folkerts (1991), most populations of *S. rosea* we have observed inhabit seepage bogs and savannas, though we have also observed them in stream terraces and swales. Usually, *S. rosea* grows with other *Sarracenia* species. We have observed it growing with *S. alabamensis* F.W.Case & R.B.Case ssp. *wherryi* F.W.Case & R.B.Case, *S. alata* (A.W.Wood) A.W.Wood, *S. flava*, *S. leucophylla*, *S. psittacina*, and *S. rubra* ssp. *gulfensis* D.E.Schnell.

Conservation

Most populations of *S. rosea* are in the western panhandle of Florida and adjacent southernmost Alabama. It is very rare in Mississippi. We have seen neither populations nor recent collections from Georgia. Where they occur, plants of *S. rosea* can be numerous. However, populations are infrequent and local in the small geographic range of *S. rosea*.

Folkerts (1977, 1982, 1990) has documented the extensive destruction of pitcher plant habitats and the consequent decline of pitcher plant abundance. Our experiences have shown habitat destruction and fire suppression to be among the most serious threats to *S. rosea*. Many other menaces exist, though. Despite the availability of reasonably priced, commercially cultivated plants of *S. rosea*, overcollection from the wild damages many populations. Twice, when visiting a locality where we had studied *S. rosea* populations, we discovered recently-dug holes and most of the plants missing. Since *S. rosea* appears to be an uncommon species, is exceptionally attractive, and faces many threats to its survival, we recommend its current conservation status be reviewed and it be considered for protection throughout its range.

KEY TO *SARRACENIA ROSEA* AND *PURPUREA*

Petals usually pink, lip 2.6–7.5 mm thick at thickest point, lip usually deeply curved roward pitcher base, scape 16.3–35.1 cm high, style arm 2.6–4.1 cm long, scape height/style arm length = 4.9–13 ..... **Sarracenia rosea**

Petals usually maroon or red, lip 0.7–3.1 mm thick at thickest point, lip usually horizontal or shallowly curved toward pitcher base, scape 22–79 cm high, style arm 1.7–2.9(–3.8) cm long, scape height/style arm length = 9.5–3 ..... **Sarracenia purpurea**

Representative Specimens

Specimens marked with an asterisk are those we measured for statistical analyses. **U.S.A. ALABAMA. Baldwin Co.:** Gateswood, 1 May 1903, *Tracy s.n.* (NY, US*); near Bay Minette, 30 May 1932, *That s.n.* (OS); 2 mi W of Seminole along route 90, 3 Apr 1966, *Kral 26187* (IBE, MICH*, VDB*); 5 mi N of Romar Beach, 26 Jul 1969, *Ellis 90* (VDB*); ca. 5 mi S of Foley on route 56, 19 Apr 1970, *Kral 38766* (VDB*); 2.6 mi S of Bay Minette, 18 May 1975, *LeLong 8482* (USAM); Gulf shores, 22 May 1975, *Kral 55708* (VDB*); Along highway 90, between Elsanor and Seminole, 23 Aug 1975, *LeLong 8631* (USAM); Off S side route 90, 14 May 1983, *Wilhelm 11333* (VDB*); N of Perdido, 18 Aug 1984, *Naczi 691 & Folkerts* (KNK); By route 112, ca. 10 mi N of Perdido River bridge, 3 May 1987, *Kral 73905* (VDB*); ca. 11 mi N of Stockton, 17 May 1987, *Naczi 1605* (KNK); N of Elberta, 28 Apr 1988, *Naczi 1803* (KNK); Perdido, 22 May 1993, *Naczi 3070* (KNK*). **Coffee Co.:** 1.5 mi NE of Kinston, 9 Jul 1932, *Wherry s.n.* (PH). **Conecuh Co.:** Highway 31 at Travis Bridge, Sepulga River, 2 Aug 1985, *Diamond 1367* (AUA). **Covington Co.:** highway 4, 13 Apr 1998, *MacDonald 11048* (IBE). **Escambia Co.:** ca. 1.5 mi E of Wawbeek, 8 Jun 1969, *Kral 35147*(IBE, VDB*); interstate 65 between roures 21 and 17, 16 May 1971, *Evans 46180* (NCU, TENN, VDB*); Little River Srare Park, 30 May 1982, *Whilhelm 10132* (VDB*); WNW of Flomaron, S of Big Escambia Creek, 27 Jun 1993, *Anderson 14411* (FSU). **Geneva Co.:** 2 mi S of Hartford, 14 May 1972, *Hanning155* (AUA); ca. 9 mi SW of Samson, 29 May 1998, *MacDonald 11314* (IBE). **Mobile Co.:** Whistler, 18 Apr 1895, *Mohr s.n.* (US 782237*); Whisrler, 18 Apr 1895, *Mohr s.n.* (US 782240*); Whistler, Mar 1918, *Graves s.n.* (MO*); Irvington, 30 Mar 1951, *Liggett 1711* (FLAS*); ca. 7 mi W of Citronelle, 7 Apr 1963, *Kral 16530* (FSU, VDB*); 3.3 mi N of Citronelle, by route 45, 3 Jun 1970, *Kral 39598* (VDB*); Along highway 188 to Coden, 23 Mar 1974, *Lelong 7450* (USAM, VDB*); W of Citronelle, along Escatawpa River, 30 Mar 1974, *Lelong 7512* (USAM, VDB*);

along highway 90, E of state line, 24 Mar 1976, *Lelong 9046* (USAM*); ESE of Bayou La Batre, 29 Apr 1988, *Naczi 1804* (KNK), 27 Apr 1991, *Naczi 2809* (KNK), 21 May 1995, *Naczi 3053* (KNK*); W of Citronelle, 22 May 1993, *Naczi 3066* (KNK*). **FLORIDA. Bay Co.:** Mill Bayou, St. Andrews Bay, 17 Mar 1926, *Banker 3556* (NY); Youngstown, 16 Mar 1937, *Exploration Party 1937* (FLAS); Panama City, 20 Mar 1943, *Sargent s.n.* (US*); 8 mi E of Panama City, 25 Mar 1949, *Hood 1699* (FLAS); Parker, 15 Apr 1971, *Athey s.n.* (WKU). **Calhoun Co.:** Myron, 5 May 1930, *Moldenke 1158* (MO*, NY); ca. 0.5 mi N of Kinard, 14 Sep 1979, *Judd 2382* (FLAS*). **Escambia Co.:** Bluff Springs, 13 Apr 1935, *Tisdale s.n.* (FLAS); 3 mi N of Cantonment, 22 Jun 1963, *McDaniel 3553* (IBE); 3 mi ESE of Pleasant Grove, 5 May 1978, *Hansen & Hansen 4784* (FSU*); Pensacola, 19 May 1993, *Naczi 3051* (KNK*). **Gadsden Co.:** inter Quincy et Aspalaga, in pinetis, May 1843, *Rugel s.n.* (US*), in uliginosis ad rivulos, May 1843, *Rugel s.n.* (FLAS, NY); [no additional locality data], [no date], *Chapman s.n.* (NY); SW of Quincy, 23 Apr 1924, *Small 11214. DeWinkeler, & Mosier* (NY). **Holmes Co.:** E of Ponce de Leon, 29 Nov 1929, *Hume s.n.* (FLAS); Ponce de Leon, 18 Mar 1937, *Exploration Party 1937* (FLAS*); SW of Leonia, 4 Apr 1958, *Godfrey 56393* (FSU*, NCU). **Liberty Co.:** 6 mi N of Vilas, 26 Feb 1956, *Kral 1965. Godfrey, & Kurz* (FSU); 4 mi N of Sumatra, 6 Oct 1963, *McDaniel 3795* (IBE); 4.2 mi N of Wilma, 6 May 1976, *Kral 57908* (IBE, VDB*); *Kral 63291* (VDB); S of junction of route 65 and route 20, 20 May 1976, *Solomon 2159* (MO*); N of Wilma, 20 May 1976, *Solomon 2180* (MO*); 21.3 mi S of Hosford, 6 Aug 1980, *Chancellor 18* (USCH*); 6 mi S of Telogia, 16 Apr 1987, *Godfrey 82347* (FSU*); S of Wilma, 21 May 1987, *Naczi 1614* (KNK); SW of Telogia [type locality], 14 Mar 1994, *Naczi 3639* (KNK*); N of Wilma, 15 Mar 1994, *Naczi 3651* (KNK*, MICH*, MO*, NY*), 4 Aug 1994, *Naczi 4502* (KNK*, MICH*); S of Wilma, 4 Aug 1994, *Naczi 4503* (KNK*). **Okaloosa Co.:** 4 mi N of Dorcas, 2 Aug 1954, *Ford 3973* (FLAS); ca. 3 mi SW of Crestview, 9 Jun 1960, *McArthur s.n.* (FLAS*); 1 mi E of Crestview, 7 Apr 1963, *Godfrey 62693* (FSU*); Eglin Air Force Base, Malone Creek, 30 Jul 1992, *Anderson 13814* (FSU); ca. 5 mi NW of Niceville, 18 May 1993, *Naczi 3026* (KNK*, MICH*); ca. 3.5 mi S of Crestview, 18 May 1993, *Naczi 3027* (KNK*); Eglin Air Force Base, Metts Creek, 24 Mar 1994, *Anderson 14698* (FSU). **Santa Rosa Co.:** N of Holt, 20 Apr 1960, *Godfrey 59425. Adams, & Henderson* (FSU, NCU); ca. 11 mi N of Holley, Eglin Air Force Reservation, 21 Jun 1967, *Smith 1549* (FLAS); ca. 6 mi N of Holley, 21 Jul 1977, *Perkins 329* (FLAS); NE of Holley, Eglin Air Force Base, 27 Mar 1994, *Anderson 14723* (FSU). **Walton Co.:** [no additional locality data], summer 1885, *Curtiss s.n.* (NY); N of DeFuniak Springs, 30 Mar 1949, *Hood 1784* (FLAS); ca. 12 mi S of DeFuniak Springs, 4 Mar 1956, *Godfrey 54407* (FSU, NY); ca. 14 mi NE of Niceville, Eglin Air Force Reservation, 29 Jun 1966, *Beckner 1429* (FLAS*); ca. 2.5 mi S of Mossy Head, Eglin Air Force Reservation, 23 Oct 1966, *Chapman 171 & Chapman* (FLAS). **Washington Co.:** 4–5 mi SW of Chipley, 16 Apr 1937, *Hobbs s.n.* (FLAS). **GEORGIA. Randolph Co.:** SW of Coleman, 28 Oct 1902, *Harper 1783* (NY, US*). **Tift Co.:** Cycloneta [now Sunsweet], 4 Feb 1892, *Rolfs* (FLAS). **MISSISSIPPI. George Co.:** S of Agricola, 28 Mar 1964, *McDaniel 4044* (IBE); Movella, 21 May 1993, *Naczi 3057* (KNK*). **Jackson Co.:** ca. 1.5 mi NE of Orange Grove, near Jackson Creek, 16 Jun 1963, *McDaniel 3539* (IBE, TENN*).

APPENDIX

Measured Specimens of *Sarracenia purpurea*

CANADA. NEW BRUNSWICK. Restigouche Co.: Charlo, 1 Aug 1894, *Fowler s.n.* (US). **NEWFOUNDLAND.** Whitbourne, 16 Aug 1894, *Robinson & Schrenk 64* (US). 15 mi W of Gander, along shoreline of Gander River, 16 Jul 1949, *Bassett 498* (MO). **Placentia West Distr.:** Pipers Hole River Bridge, route 11, 25 Jul 1960, *Rouleau 5770* (US). **St. Mary's Distr.:** ca. 3.5 mi N of Riverhead, 16 Aug 1961, *Rouleau 7068* (US). **Labrador:** Goose Bay, 26 Jun 1950, *Gillett 5123 & Findlay* (US).

NOVA SCOTIA. Canso, 12 Jul 1901, *Fowler s.n.* (US). Cape Breton National Park, west side, 1 Sep 1947, *Scallen 9880* (US). **Inverness Co.:** Cape Breton Highlands National Park, White Capes region, 16 Jul 1970, *Uttal 7415* (FSU). **ONTARIO. Algoma Distr.:** 3 mi past Anjigami along road following powerline, 20 mi NE of highway 17, T28, R22, 47° 53'N, 84° 37'W, 15 Aug 1971, *Garton 14741 et al.* (MICH). **Bruce Co.:** 8 mi N of Southampton, South Sauble Beach, in Silver Lake, 17 Jun 1948, *Soper 3935 & Dale* (US). **Carleton Co.:** Carlsbad Springs, 25 Jun 1947, *Cody & Calder 517* (US). **Dufferin Co.:** ca. 5 mi NW of Grand Valley, Luther Marsh Wildlife Area, Wylde Lake, 19 Aug 1994, *Naczi 4514* (KNK). **Parry Sound Distr.:** Opposite Shawanaga Township, Big Island, off Eagle Lake, 23 Jul 1942, *McDonald 244* (US). **Renfrew Co.:** 5 mi E of Deux Rivieres, Gibson Lake, along S side of route 17, 18 Jun 1987, *Naczi 1701* (KNK). **Thunder Bay Distr.:** Sibley Provincial Park, SE side of Sibley Peninsula, back of Middlebrun Bay, 20 Jul 1961, *Voss 10138* (MICH); ca. 12–14 mi NW of Manitouwadge, 10 mi N of Nama Creek bridge on Manitouwadge-Caramat Industrial Road, 19 Jul 1964, *Voss 11639* (MICH); Thunder Bay City, just N of Northwood Park area, 26 Jun 1975, *Garton 16525* (MICH); 18 km. NW of Dotion on Spruce River cut-off, 1 Jul 1979, *Garton 18798* (MICH). **Wellington Co.:** 2.1 mi S of junction of Watson Road and Arkell Road in Arkell, 18 Aug 1994, *Naczi 4513* (KNK). **QUEBEC.** Magdalen Islands, Grindstone Island, Grindstone, 17 Jul 1912, *Fernald 7531 et al.* (US). **SAINT-PIERRE ET MIQUELON.** Ile Saint-Pierre, vicinité de ville Saint-Pierre, 24 Nov 1993, *Etcheberry s.n.* (KNK). **U.S.A. CONNECTICUT. Tolland Co.:** Stafford, Jul 1898, *Morris s.n.* (US). **DELAWARE. Sussex Co.:** E of Millsboro, 21 Jun 1924, *Tidestrom 12115* (US). **GEORGIA. Tattnall Co.:** Sand-hills of Ohoopee River near Reidsville, 26 Apr 1904, *Harper 2151* (MO). **INDIANA. Wells Co.:** Jackson Township, 24 Jul 1905, *Deam 91* (US). **MAINE. Hancock Co.:** Between Brooklin and Sedgwick, 8 Jul 1915, *Safford 83* (US). **MASSACHUSETTS. Norfolk Co.:** Canton, 26 May 1894, *Churchill s.n.* (MO); Canton, 11 Aug 1926, *Standley & Blake s.n.* (US). **MICHIGAN. Cheboygan Co.:** N of Riggsville, 8 Jul 1986, *Naczi 1400* (KNK). **Livingston Co.:** ca. 4.5 mi W of Brighton, 22 Aug 1994, *Naczi 4515* (KNK). **Mackinac Co.:** ca. 5 mi N of Epoufette, 6 Jul 1987, *Naczi 1742* (KNK). **MINNESOTA. Cass Co.:** Gull Lake, Jun 1893, *Ballard s.n.* (US). **St. Louis Co.:** 18 mi N of Duluth, 18 Jun 1939, *Lakela 2983* (MO). **NEW HAMPSHIRE. Coös Co.:** Shelburne, 19 Jun 1915, *Deane s.n.* (US). **Cheshire Co.:** Chesterfield, 21 Jul 1972, *Boufford 7243* (MO). **NEW JERSEY. Atlantic Co.:** 2 mi NW of Pleasant Mills, 26 May 1952, *Hermann 3054* (MICH); Pleasant Mills, 26 Nov 1993, *Naczi 3573 & Naczi* (KNK). **Bergen Co.:** Demarest, 30 May 1876, *Brown 1294* (MICH). **Burlington Co.:** Martha, along E side of Oswego River, 5 Jun 1982, *Naczi 156A* (KNK), 26 Nov 1993, *Naczi 3572 & Naczi* (KNK); ca. 4 mi N of Chatsworth, 26 Nov 1993, *Naczi 3563 & Naczi* (KNK); Quaker Bridge, ca. 5 mi N of Batsto, 21 Jun 1994, *Naczi 4432 & Thieret* (KNK), *Naczi 4433 & Thieret* (KNK), *Naczi 4434 & Thieret* (KNK). **Camden Co.:** Spring Garden, 4 Jul 1868, *Redfield s.n.* (MO). **Cumberland Co.:** ca. 2 mi N of Newport, 21 Jun 1994, *Naczi 4392 & Thieret* (KNK). **Gloucester Co.:** Malaga, 15 Aug 1926, *Adams 458* (MO). **Middlesex Co.:** 2 km N of Helmetta, 6 Jun 1966, *Kane & Coyne s.n.* (US). **Morris Co.:** Succasunna, 13 Jun 1909, *Mackenzie 4119* (US). **Ocean Co.:** Lakehurst, 30 May 1904, *Dowell 3670* (MO), ca. 4 mi S of Whiting, 26 Nov 1993, *Naczi 3570 & Naczi* (KNK). **Sussex Co.:** Budd's Lake, 12–14 Aug 1890, *Small s.n.* (US). **NEW YORK. Onondaga Co.:** Cicero Swamp, Jun 1901, *House s.n.* (US). **Rensselaer Co.:** Taborton, Cranberry Vly Creek, 25 Jul 1994, *Tucker 10058 & Miller* (KNK). **NORTH CAROLINA. Brunswick Co.:** 1 mi E of Brunswick-**Columbus Co.:** 7 May 1965, *Chen 442* (USCH); ca. 9 mi NW of Supply, 20 Dec 1994, *Naczi 4539* (KNK); 5.0 mi NW of Supply, 20 Dec 1994, *Naczi 4541* (KNK). **Catawba Co.:** Near Hickory, 23 Jun 1893, *Heller 1014* (MO). **Carteret Co.:** near the town of Sealevel, 24 Aug 1979, *Angerman s.n.* (USCH). **Columbus Co.:** Delco, 26 Jul 1938, *Braun s.n.* (US). **Harnett Co.:** Lillington, 24 Mar 1966, *Coyne & Coyne s.n.* (US). **Henderson Co.:** swamps of Muddy Creek, 21 Aug 1881, *Smith s.n.* (US); ca. 10.5 mi SW of Hendersonville, 12 Dec 1994, *Naczi & Hill 4520* (KNK). **Jackson Co.:** S of Cashiers, 11 Dec 1994, *Naczi 4519 et al.* (KNK). **Montgomery Co.:** Black Ankle, 26 May 1988, *Naczi 1975* (KNK). **New Hanover Co.:** near Wilmington, Apr 1888, *McCarthy s.n.* (US); S of Kirkland, 15 May 1930, *Moldenke 1238* (US). **Onslow Co.:** 3.5 mi SW of Maysville, 28 May 1977, *Kral 60229* (VDB). **Pender Co.:** 1 mi N of Burgaw, 11 May 1960, *Kral 10101* (VDB); Holly Shelter Wildlife Refuge, 19 May 1962, *Kral 14723* (VDB); Burgaw bog, 6 May 1968, *Wiggs & Jenkins s.n.* (USCH). **Robeson Co.:** N side of Lumberton off route 74, 27 Aug 1963, *Kral 19135* (VDB). **Tyrell Co.:** near Kilkenny, 8 May 1938, *Kerr & Godfrey 3864* (US). **OHIO. Lorain Co.:** Camden, 18 Jun 1894, *Oberlin s.n.* (US). **PENNSYLVANIA. Bradford Co.:** ca. 2.2 mi SSW of Leroy, Barclay Mountain, 17 Jun

1994, *Naczi 4322 & Thieret* (KNK). **Tioga Co.**: ca. 3 mi S of Leetonia, 25 Jun 1994, *Keener 94026* (KNK). **SOUTH CAROLINA. Chesterfield Co.**: 6 mi SSW of Cheraw, 20 Dec 1994, *Naczi 4523* (KNK). **Darlington Co.**: Hartsville, 29 Jul 1920, *Norton s.n.* (US); Hartsville, Along E side of Kilgore's Branch, 20 Jul 1941, *Smith 877* (USCH). **Georgetown Co.**: 5.5 mi S of Georgetown, 29 Jun 1939, *Godfrey & Tryon 211* (MO). **Greenville Co.**: E of Caesars Head, 11 Dec 1994, *Naczi 4518 et al.* (KNK); E of Caesars Head, 31 May 1995, *Naczi 4755A & Naczi* (KNK). **Horry Co.**: Cotton Patch Bay area, 19 May 1987, *Batson & Thompson s.n.* (USCH). **Kershaw Co.**: E of Camden, 25 Jun 1984, *Salim et al. 4* (USCH). **Lexington Co.**: Platte Spring's Road, 4 May 1939, *Heckenkleikner s.n.* (USCH). **VIRGINIA. Chesterfield Co.**: near Chester, 6 Jun 1936, *Wilmouth* (US). **Greensville Co.**: ca. 1 mi NW of Dahlia, 7 Jun 1946, *Fernald & Moore 15090* (MO).

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